

Chapter 7: Public Health/Aquatic Life Concerns

The potential presence of toxic substances in surface water, groundwater and drinking water is a concern for individuals, businesses and governments. As more is understood about known and potential effects of individual contaminants — as well as suspected synergistic effects of multiple contaminants — the public is demanding to know more about ambient water quality supplies and quality of water at the tap.

Federal and state requirements address these concerns, in part, through — for example — reporting requirements for communities on the vulnerability of drinking water systems to potential contaminant sources under the state's drinking water program or through protection afforded surface waters through the state's stringent provisions regulating the calculation of effluent limits for toxic substances found in NR106.

Major topical areas in this section include water quality assessments detailing the presence of and resulting impairments from toxic substances; aquatic life toxicity testing; fish consumption advisories, fish kill data reported during the 2000-2001 period, sediment contamination sites, reports of beach closings, incidents of waterborne disease and assessments of surface waters for drinking water use designation.

Water Quality Assessments - Toxic Substances

Table 31 below reports waters monitored for toxic substances and those with elevated levels of toxicants. *Streams are reported in Part III, Chapter 3.* Of the 24,422 miles monitored or evaluated, 1,138.25 miles of rivers or streams are partially or not supporting their designated uses due to elevated levels of toxic substances in the water column, fish tissue, or discharges.

Due to fish advisories, the entire length of Wisconsin Great Lakes shoreline miles (1,017) are considered to have elevated levels of toxicants. Pollutant sources to the Great Lakes are many, including airborne toxicants like mercury, sediments contaminated in the past, tributaries carrying toxic runoff, and wastewater discharges.

Table 31. Total Size of All Waterbodies Affected by Toxicants

Waterbody	Size monitored for toxicants*	Size with elevated levels of toxicants
River (miles)		1138.25 (1)/ (2)
Lakes (acres)		
Great Lakes (miles)	1017	1017 (3)

(1) From USEPA database includes waterbodies monitored and evaluated

(2) Stream miles under fish consumption advisories

(3) Based on fish consumption advisories

Aquatic Life Toxicity Testing

The WDNR works cooperatively with the University of Wisconsin-Madison's State Laboratory of Hygiene (SLH) to maintain a biomonitoring laboratory. This laboratory maintains cultures of several fresh water species and is capable of performing acute and chronic toxicity tests on effluent, ambient waters, and sediment samples collected statewide. The laboratory also provides sample collection services for these and other tests. Laboratory staff participate on WDNR policy teams dedicated to the development of new and improved toxicity testing methodologies. Additionally, WDNR and laboratory staff assess the applicability of alternative toxicological assessment methods to other WDNR watershed management programs. For example, during 1997-2000, the laboratory conducted research to improve algae toxicity test methods (with *Raphidocelis subcapitata*) for future addition to the chronic toxicity test battery required in Wisconsin Pollutant Discharge Elimination System (WPDES) permits.

Each year, the laboratory accepts requests for toxicity testing from WDNR basin engineers and permits staff. WDNR staff select facilities to be tested by the laboratory in order to collect data for

compliance inspections, permit reissuances, and enforcement situations. The tests completed in 2000-2001 are summarized below (see Table 32).

Excluding monthly batteries of reference toxicant tests, acute and chronic test batteries performed on WPDES-permitted facilities made up the majority of toxicity tests conducted in 2000 and 2001. Specifically, 54 acute test batteries were performed on wastewater effluent using two freshwater species: a waterflea (*Ceriodaphnia dubia*) and juvenile fathead minnows (*Pimephales promelas*). Municipal effluent accounted for 33 of those test batteries, 15 came from industrial dischargers, and 6 came from WDNR-owned fish hatcheries. While the majority of wastewater effluent samples were non-toxic, 4 indicated a high potential for acute toxicity (2 municipal, 2 industrial). The cause of toxicity was not determined in most cases, but is being addressed via WPDES permitting activities. Additional testing and/or toxicity identification will be recommended in future WPDES permits to further characterize the potential for significant effluent toxicity from these facilities.

Table 32. Summary Of SLH Toxicity Test Results For 2000-01

Sample type	Results			Results		
	#of acute	Pass	Fail	#of chronic	Pass	Fail
WPDES Industrial	15	13	2	12	8	4
WPDES Municipal	33	31	2	31	18	13
WPDES WDNR-owned fish hatcheries	6	6	0	8	8	0
Sediment	NA	NA	NA	12	10	2
Ambient Surface Water	107	107	0	116	86	30
Totals	161	157	4	179	130	49

NA = not applicable

Chronic toxicity test batteries using, *C. dubia*, larval fathead minnows, and algae (*R. subcapitata*) were also conducted at 51 sites: 31 municipal, 12 industrial, and 8 WDNR-owned fish hatcheries. While the majority of wastewater effluent samples were non-toxic, 17 indicated a high potential for chronic toxicity (13 municipal, 4 industrial). The cause of the toxicity was not determined in most cases, but is being addressed via WPDES permitting activities. Additional testing and/or toxicity identification will be recommended in future WPDES permits to further characterize the potential for significant effluent toxicity from these facilities.

WDNR's sediment management program continues to benefit from the ability of laboratory staff to conduct sediment toxicity tests. Acute and chronic toxicity tests using *C. dubia*, a midge larvae (*Chironomus tentans*) and an amphipod (*Hyalella azteca*) were performed on 12 sediment samples in 2000 and 2001.

The lab also applied the acute and chronic toxicity testing techniques to several additional sample types. For example, 86 stormwater runoff and receiving water samples from areas near the Milwaukee airport were analyzed for toxicity in order to determine the potential of deicing chemicals to impact nearby surface waters. Also, 87 surface water samples from other areas of the state were tested to assess the potential for acute and chronic toxicity in lakes and rivers at those sites. 8 individual chemicals were also tested at the lab in order to provide toxicological data to assist the Department in developing water quality criteria. Other testing at the lab in 2000-2001 included tests to:

- to assess the cause of fish kills and in emergency spill situations;
- to determine the potential impacts to surface waters from landfill leachates;
- to investigate the sensitivity of early life stages of burbot and northern pike, in support of WDNR efforts to develop water quality standards for ammonia; and
- to determine whether endocrine disrupting compounds were present in source water, drinking water, and wastewater effluent samples.

WDNR and the SLH efforts in the next biennium will continue to emphasize monitoring for WPDES-permitted facilities. Efforts will also be made to generate additional ambient toxicity data and to further supplement the toxicological database for compounds needing water quality criteria.

In addition to WDNR toxicity monitoring conducted by the SLH, WPDES-permitted facilities are evaluated by WDNR staff to determine their potential for acute and chronic toxicity. If it is determined that potential for effluent toxicity is present, permits require that acute and/or chronic whole effluent toxicity (WET) tests be performed during the permit term. The need for WET testing is evaluated using data regarding available dilution, industry type, type and number of industrial contributors to municipal treatment plants, detection of chemical-specific compounds, additive use, and other factors.

In Fiscal Years 2000-2001, 223 WPDES-permitted facilities (128 municipal, 95 industrial) conducted 363 acute tests, as required by their permits (see Table 33). Twenty of the 207 tests (9.6%) conducted by municipal dischargers demonstrated positive acute toxicity. Twelve municipal facilities experienced acute toxicity, but only three had severe or repeated toxic events. Twelve of 156 tests (7.6%) conducted by industrial dischargers demonstrated positive chronic toxicity. Eleven industrial dischargers experienced acute toxicity, but only one had repeated toxic events. In these cases where repeated or severe toxicity was noted, facilities are doing additional testing and/or toxicity identification in an attempt to identify the source(s) of toxicity.

In Fiscal Years 2000-2001, 175 WPDES-permitted facilities (115 municipal, 60 industrial) conducted 337 chronic tests, as required by their permits (see Table 33). Twenty-three of the 221 tests (10.4%) conducted by municipal dischargers demonstrated positive chronic toxicity. Eighteen municipal facilities experienced chronic toxicity, but only three had severe or repeated toxic events. Twenty-five of 116 tests (21.5%) conducted by industrial dischargers demonstrated positive chronic toxicity. Thirteen industrial dischargers experienced chronic toxicity, with five showing repeated toxic events. In these cases where repeated or severe toxicity was noted, facilities are doing additional testing and/or toxicity identification in an attempt to identify the source(s) of toxicity.

Table 33. Summary Of WPDES Toxicity Test Results For 2000-01

Sample type	#of acute		Results		#of chronic		Results	
	Facilities	Tests	Pass	Fail	Facilities	Tests	Pass	Fail
WPDES Industrial	95	156	144	12	60	116	91	25
WPDES Municipal	128	207	187	20	115	221	198	23
Totals	223	363	331	32	175	337	289	48

Fish Consumption Advisories

Wisconsin issued the year 2000 update of *Important Health Information for People Eating Fish from Wisconsin Waters*, the fish advisory for Wisconsin waters. With the 2000 update, almost 400 specific waterbodies or segments were listed with advice due to fish containing mercury or PCBs and other chemicals.

In 2001, Wisconsin changed the method for issuing fish consumption advisories as well as the format of the advice after new information showed that lower amounts of mercury are harmful to developing fetuses and young children. The National Academy of Sciences recommended that US EPA's reference dose for mercury be used for issuing fish consumption advice. A new general statewide advisory was developed based on the new effect levels and typical levels of mercury found in Wisconsin fish based on the mercury concentration data that Wisconsin amassed over the last 20 years. See Table 35 for a list of health criteria used for Wisconsin's advisories.

This new statewide advisory applies to most inland waters where other pollutants or where mercury concentrations do not require more stringent advice. Some waters contain fish with higher levels of mercury or PCBs and other pollutants that require more stringent fish consumption advice. In all, the advisory lists fish from 59 of the more than 2,000 lakes, river segments, and

border waters tested (Table 34) due to the presence of PCBs and other organic chemicals. The number of surface water segments with PCB-based advisories has remained fairly constant since 1990.

Since the adoption of the statewide general mercury advisory, the specific number of surface waters listed with more stringent advice is 92. This is because the new statewide general advisory provides equivalent advice and replaces the need to list many of the specific waters.

Table 34. Wisconsin's Fish Contaminant Monitoring and Cumulative Advisories

Year	Sites Sampled	Samples Collected	TOTAL Reaches or Waters w/Advisories PCB/Mercury
Prior to 1980	234	3,003	7/0
1980-1989	939	11,139	22/161
1990-1999	683	11,565	58/322
2000	96*	806*	59/331
			statewide mercury advisory adopted
2001	57*	407*	59/92
Total	2,009*	26,920*	59/92

* estimated at time of publication

Table 35. Wisconsin Fish Consumption Advisory Guidelines

Contaminant	Population	Concentration	Advice
PCB ¹	All	< 0.05 ppm	Unlimited Consumption
		0.05 – 0.2 ppm	1 meal/week or 52 meals/year
		0.2 – 1.0 ppm	1 meal/month or 12 meals/year
		1.0 – 1.9 ppm	6 meals/year
		> 1.9 ppm	Do Not Eat
Mercury	Sensitive Group ²	< 0.05 ppm	Unlimited Consumption
		0.05 – 0.22 ppm	1 meal/week or 52 meals/year
		0.22 – 1.0 ppm	1 meal/month or 12 meals/year
		> 1.0 ppm	Do Not Eat
	General Group ²	<0.16 ppm	Unlimited Consumption
		>0.16/>0.5 ppm	1 meal/week or 52 meals/year
Dioxin ³	All	< 10 ppt	No Advice Given
		> 10 ppt	No one should eat
Chlordane	All	< 0.16 ppm	No advice given
		0.16 - 0.65 ppm	1 meal/week or 52 meals/year
		0.66-2.82 ppm	1 meal/month or 12 meals/year
		2.83-5.62 ppm	6 meals/year
		> 5.62 ppm	No one should eat

1. Although this advice is based on reproductive health effects, the same advice is given for women, children, and men to protect against other potential health effects such as immune suppression and cancer

2. Sensitive group includes pregnant women, women of childbearing age, and children under age 15. General Group includes women beyond childbearing age and men.

3. Sum of total dioxin equivalence expressed as 2,3,7,8 TCDD based on dioxin and furan congeners and EPA human health TEFs.

Sites of known sediment contamination

The following table lists ongoing sediment remediation sites in the state as of 1/01/02. The status column indicates what level of monitoring or management has occurred at the site since discovery.

Table 36. Sites of Known Sediment Contamination

Region	Project Name	GMU & Waterbody	Status**	Current & Projected Status FY 2000-2001
NER	Marinette MGP - WPS	Upper Green Bay GMU: Menominee R.	1	Initial site assessment completed; schedule for work plan for additional assessment due.
NER	Green Bay MGP - WPS	Lower Fox R.	1	FS for on-shore due. Initial sediment assessment completed.
NER	Two Rivers MGP - WPS	Lake Shore GMU: E. Twin River	1	Initial sediment assessment completed.
NER	Oshkosh MGP - WPS	Upper Fox R. GMU: L. Winnebago	2	Initial sediment assessment completed. More work needed.
NER	Appleton MGP - WEPCO	Lower Fox R.	1	Initial site assessment completed; coal tar found in the river from a DOT project.
NER	Manitowoc MGP - WF&L	LakeShore GMU: Manitowoc R.	3	Solidification pilot study completed and apparently unsuccessful.
NER	Menominee R. - Ansul Corp.	Upper Green Bay GMU: Menominee R.	2,3	Barrier installed around site. Eighth street slip sediments removed. Extent and degree studies of contamination in the turning basin under review.
NER	Sturgeon Bay- Shipbuilding Co.	Lake Shore GMU: Sturgeon Bay Canal	4	Site remediations complete in 1998.
NER	Ripon MGP - Alliant	Upper Fox R. GMU: Silver Cr.	1	Initial sediment assessment completed in September 2000.
NER	Kewaunee Marsh - Wis. Central Railroad,DNR	Lake Shore GMU: Kewaunee R.	4	Interim remediation measures implemented. Decision on effectiveness of interim measures and long -term solution pending. Funding for additional monitoring needed.
NER	Lower Fox R. from Neenah to the mouth - PCB Deposits	Lower Fox River	2	Site identification, remedial investigation, and priorities are in discussions. Pilot projects "N" and "56-57" have been implemented.
NER	Hayton Millpond	Pine & Jordan Creeks,& ditches; Hayton Millpond	2,3	Site investigations complete, and FS completed. Discussions for remedy are taking place. Initial source removal in OU-1 to take place in 2001.
NER	Fond du lac R.	Upper Fox R. GMU	1	Initial sediment sampling indicated potential high levels of metals and a potential coal gas site impact. Toxicity samples collected in fall of 2000.
NOR	Rhineland Landfill - City of Rhineland	Upper Wis. GMU: Slaughterhouse Creek & Pelican R.	2	Various remediation measures completed, including phytoremediation; chemical monitoring of surface waters on going.
NOR	Crawford Cr. - Koppers Corp.	Lake Superior GMU: Crawford Creek	2	Site investigation continuing; Screening ecological risk assessment completed. Decisions about additional monitoring for assessment continuing.
NOR	Ashland MGP- NSP	Lake Superior GMU: Chequamegon Bay	2	Designated as a Superfund Site in fall 2000. Discussions over risk assessments are continuing with EPA.
NOR	Superior Harbor - Fraser Shipyards	Lake Superior GMU: Superior Bay	2	Under enforcement.
NOR	Military Cr. at Phelps - C.M. Christenson	Upper Wis.GMU: Military Creek	1	Initial site assessment completed; additional assessment discussions needed.
NOR	Lincoln Woods Coal Gas Site	Central Wis. GMU	2	Initial sediment assessment completed. High levels of coal gas waste found. Discussions with RP will begin in spring 2001.

continued

Region	Project Name	GMU & Waterbody	Status**	Current & Projected Status FY 2000-2001
NOR	Newton Creek - Murphy Oil	Lake Superior GMU: Impoundment, Newton Creek, Hog Isle Inlet	4,2	Company remediated impoundment and first 700' of creek. Dept.'s consultant conducted additional site investigation of the next 2 segments of the creek. Scope of work under review for additional assessment on the remainder of the creek & impoundment.
WCR	Wausau Steel	Central Wis. GMU: Big Rib R.	4,5	Sand & geotextile cap installed in winter of 1998. Post observation and monitoring of cap effectiveness necessary.
WCR	Wausau MGP - WF&L	Central Wis. GMU: Wis. R.	1	Needs site assessment.
WCR	Wis. R. at Wausau below Rothschild Dam.	Central Wis. GMU: Wis. R.	1	Some assessment work needed due to past spills.
WCR	Former Eau Claire STP outfall	Upper Chippewa R. GMU: Chippewa R. at Eau Claire	2	DNR assessment completed Levels of PAH's not as high as once thought.
WCR	Miss. R. at Fountain City - Army Corp. of Eng.	Miss. R. at Fountain City	4,5	ACE implemented a removal in 1999.
WCR	LaCrosse MGP site	LaCrosse.	1	Needs sediment site assessment.
WCR	Chippewa Falls MGP site	Duncan Cr.	1	Needs sediment site assessment.
WCR	Chippewa/ Eau Claire MGP site		1	
WCR	Wis. R. at Port Edwards -	Central Wis. GMU: Wis. R. Vulcan Materials	4	Site clean- up completed in 1998. No post-remediation required as a part of the clean-up agreement.
WCR	Wis. R. at Stevens Point MGP site - WPS	Central Wis. R. GMU: Wis. R. at Stevens Point	2	Additional sediment sampling has occurred in the pond and at the confluence and downstream in the river. Needs interpretation.
SCR	Wis. R. at Badger Army Ammunition plant	Wis. R. at Gruber's Grove Bay	4	Site investigation completed, extent of contamination defined in 2000 and clean-up objective finalized. Dredging to occur in 2001.
SCR	OECI Superfund Site Ashippun	Upper Rock GMU: Davy Creek	4	Post assessment monitoring needed.
SCR	Baraboo River - MGP site	Lower Wisc. GMU: Baraboo river	4	Remediation completed in the winter of 1999.
SER	Sheboygan R. Superfund Site; Tecumseh Products	Sheboygan R. GMU: Sheboygan R. below Sheboygan Falls	3	ROD issued; final remedy discussions are still occurring. SQO's are .5ppm in water, 10ppm in the floodplain
SER	Sheboygan R. MGP - WPS Sheboygan R. in Sheboygan	Sheboygan R. GMU:	1	Remediation of upland is ongoing. Needs more sediment assessment.
SER	Fox R. (ILL.) MGP - WEPCO	Illinois/Fox R. GMU: Fox R. at Waukesha	1	Sediment assessment needed.
SER	Milw. R. - Milw. Third Ward MGP - Wis. Gas Co.	Milwaukee River GMU: Milwaukee R. in Milw.	1	Site investigations needed
SER	Milw. R. - North Ave. Dam	Milwaukee River GMU: Milwaukee R. in Milw.	4	Dam removal completed. Shore stabilization completed.
SER	Cedar Creek - Mercury Marine	Milwaukee River GMU: Cedar Creek Below Cedarburg	3	Discussions are occurring regarding sediment assessment of the Hamilton Impoundment.
SER	Milwaukee R. & Cedar Cr.	Milwaukee River GMU: Cedar Creek to the harbor	2	EPA funded grant for transport modeling and associated reports are in preparation.
SER	Moss American Superfund Site	Milwaukee River GMU: Little Menomonee River	3	Discussions continue with EPA/WDNR and the responsible party regarding clean - up of the existing channel as opposed to digging an alternative channel.
SER	SC Johnson	Illinois/Fox R GMU: Waxdale Creek	1	Initial samples collected.

** Status Key:

- | | | |
|------------------------|--------------------------|--------------------------------|
| 1. Initial discovery | 3. Remedial design | 5. Post-remediation monitoring |
| 2. Detailed assessment | 4. Remedy implementation | |

Restrictions on bathing areas

In October 2001, U.S. EPA awarded a “developmental” grant to the State of Wisconsin under the BEACH Act of 2000 (Beach Environmental Assessment and Coastal Health) to finance the development of a consistent beach water-testing program aimed at reducing the risk of exposure of beach users to disease-causing microorganisms in beach water.

The project will bring together a work-group of state environmental and public health officials, local health officials, and other interested parties to design a beach monitoring and notification program that will meet the requirements of the grant. As a provision of the BEACH Act, EPA may also award an “implementation” grant of approximately \$200,000 annually to the State of Wisconsin for the purpose of financing the full implementation of the statewide coastal beach monitoring and public notification program.

In addition, the DNR Bureau of Research has an EPA grant to determine the occurrence and origins of pathogens in urban streams using the Milwaukee Basin as the area of interest. The study will investigate *E. coli*, Salmonella, Crypto, Giardia and other pathogens during wet and dry events.

Water Quality Standards for Bacteria

Water quality standards define a relationship between the amount of bacteria in the water and the potential risk to human health. Swimming in water with bacteria concentrations that are in compliance with the standard will not eliminate the risk of illness, but the risk of disease due to exposure is decreased.

EPA-established guidelines were derived from studies conducted in the 1970's and 1980's. In 1986 EPA recommended that *E. coli* and/or Enterococci be used as an indicator of fecal contamination. The EPA standard was set at a geometric mean of 126 colonies per 100 milliliters (mL) for *E. coli* in freshwater systems and 33 colonies per 100 mL for Enterococci in marine systems. These numbers are correlated with an illness rate of 8 individuals per 1,000 swimmers. Wisconsin's water quality standards are currently expressed as a fecal coliform standard. The Clean Water Act, as amended by the BEACH Act, requires Wisconsin to adopt new or revised water quality standards for pathogens and pathogen indicators for which EPA has published criteria. Under the statute, Wisconsin DNR must adopt new standards based on *E. coli* by April 10, 2004.

Economic Impacts of Beach Pollution

According to a report by the Natural Resources Defense Council, at least a third of all Americans visit coastal and Great Lake counties and their beaches annually. Recreational water tourism, attributable in part to clean beaches, generates substantial revenues for state and local governments. Polluted beaches not only cost local economies tourist dollars and jobs, but they also cause a loss to those who had planned to visit the beach and swim in the water. Economists estimate that a typical swimming day is worth \$30.84 to each individual. Depending on the number of potential visitors to a beach, this “consumer-surplus” loss can be quite significant.

Addressing the sources of pollution so that beach water does not pose a health risk is the optimal solution that will take significant time and money. In the meantime however, it makes sense from a public health perspective to monitor beach water and advise beach users of health risks associated with elevated bacteria levels at contaminated beaches. Such advisories, if used effectively, can provide beach-specific information that will discourage beach users from swimming and running the risk of getting sick. Given the large number of people using beaches, as well as the substantial income from recreational water tourism, the cost of establishing a beach-monitoring program is reasonable and will be supported.

Source Water Assessment Program

The 1996 Amendments to the Safe Drinking Water Act require states to have an USEPA-approved Source Water Assessment Program (SWAP). The purpose of the program is to protect public health by providing information that can be used to prevent contamination of public water supplies. Other benefits include: preserving water resources for future generations; avoiding the expense of cleaning up a contaminated water supply or finding alternative sources of water; reducing system costs by providing the information needed to apply for a waiver from specific monitoring requirements; and encouraging economic growth by assuring an abundant supply of clean water.

Wisconsin is currently in its third year in implementing its Source Water Assessment Program (SWAP). Assessments for each public water supply include: 1) delineation of source water area boundaries; 2) inventory of significant potential sources of contamination within those boundaries; 3) determination of susceptibility for each system; and 4) release of the assessment results to the public water supplier and to the public. Assessments must be completed for both groundwater and surface water systems. Wisconsin has until May 6, 2003 to complete all source water assessments.

Source water assessments for drinking water systems using surface water are nearly complete. These systems provide drinking water to 1.5 million people in communities along Lakes Michigan, Superior and Winnebago. Surface water source water areas are shown below. Source water assessments for drinking water systems using groundwater are in various stages of completion. Municipal systems are targeted to be completed by the end of 2003. Remaining public water systems will be assessed by the end of 2004.

Figure 41. Surface Water Source Water Protection Areas developed through the Source Water Assessment Program under the Safe Drinking Water Act.

